

Claims

- 5 1. A remote polling and control system in a heterogeneous wireless data transmission network for communication between a variety of wireless nodes (PUs, SAs and/or SPs) interconnected via said network, characterized by
- 10 control means (PU) for polling (S1b) data from remotely accessible nodes (SPs) of a first type located in said network and/or remotely controlling (S1c') functions executable by remotely controllable nodes (SAs) of a second type, said nodes (SAs, SPs) being in a stand-by mode before and after
- 15 being called by said control means (PU).
2. A remote polling and control system according to claim 1, wherein said communication is organized according to the master-slave principle,
- 20 characterized by
- at least one master node (PU) comprising an RF transceiver (aTx and aRx) designed to
- send (S0a) a wake-up signal to at least one remote slave node (SP, SA) of a first and/or second type for polling
  - 25 (S0b) information detected by said slave node (SP, SA),
  - send (S0c) control information for triggering a function to be executed by at least one remotely controllable slave node (SA) of said second type, and
  - receive (S0d) feedback information from said slave nodes
  - 30 (SA and/or SP).
3. A remote polling and control system according to anyone of the claims 1 or 2, characterized in that

said network (WSN) is configured in a meshed, star or hybrid star and meshed topology.

4. A remote polling and control system according to claim 3,  
5 said network (WSN) having a meshed topology for a peer-to-peer-based ad-hoc communication between wireless nodes (PU, SA, SP),

characterized by

a CSMA-based MAC protocol for guaranteeing collision avoidance  
10 when different nodes (PUs, SAs and/or SPs) are trying to simultaneously transmit data.

5. A remote polling and control system according to claim 2, characterized in that

15 the remote slave node (SP) of said first type comprises

- receiving means (pRx) for wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node (PU) to said slave node (SP),

- 20 - transmitting means (pTx) for wirelessly transmitting (S2b) sensor data or requested status information to said master node (PU) upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any  
25 other node with an encoded signal representing said status information, and

- processing means for processing (S2c) and creating (S2c') dynamic data.

30 6. A remote polling and control system according to claim 2, characterized in that

the remotely controllable node (SA) of said second type comprises

- receiving means (pRx) for wirelessly receiving (S3a) a  
35 wake-up and remote control signal from the master node (PU)

or another node of said second type (SA),

- optional sensor elements (SSA) for detecting (S3b) operational parameters of said slave node (SA) and/or environmental data and/or remotely controllable actuator elements (ASA) for executing (S3c) programmable actions,
- processing means for executing (S3d) a remotely controllable application running on said node (SA) for monitoring (S3e) and gathering (S3e') sensor data detected by said sensor elements (SSA) and/or controlling (S3e'') said actuator elements (ASA), and
- transmitting means (aTx) for wirelessly transmitting (S3f) information from said application to said master node (PU) upon reception of said wake-up and remote control signal.

7. A remote polling and control system according to claim 2, 5 or 6,

characterized by

said remotely controllable slave node (SA) of said second type additionally comprises

transmitting means (pTx) for wirelessly transmitting (S3g) data or requested status information upon reception of a polling request message from a further node (SA') by back-scattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node with an encoded signal representing said status information to said further node (SA') when being operated in a mobile ad-hoc network having a meshed topology and communicating with said further node (SA') on a peer-to-peer basis.

8. A remote polling and control system according to anyone of the claims 2 or 5 to 7,

characterized in that

said master node (PU) is connected to a bridge (B) providing a wireless or wired communication link to at least one other master module (PU').

9. A method for enabling at least one master node (PU) of a remote polling and control system (430, 450, 460 or 470) in a heterogeneous wireless network according to anyone of the claims 2 to 8 to remotely control at least one slave node (SA, SP),

characterized in that

said master node (PU) performs the steps of

- transmitting (S1a) a wake-up and control signal for polling (S1b) sensor data detected and/or data created and/or processed by a remotely accessible slave node (SP) of a first type located in the range of said master node (PU) or any other node providing an electromagnetic field to be modulated by said slave node (SP) and/or
- remotely activating (S1c), controlling (S1c') and/or deactivating (S1c'') functions executable by a slave node (SA) of a second type, said slave nodes (SA, SP) being in a stand-by mode before and after being called by the master node (PU).

10. A method according to claim 9,

characterized in that

the slave node (SP) of said first type performs the steps of

- wirelessly receiving (S2a) a wake-up signal indicating a need for transmitting a polling request message from said master node (PU) to said slave node (SP),
- wirelessly transmitting (S2b) data or requested status information to said master node (PU) upon reception of said polling request message by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node with an encoded signal representing said status information, and
- executing (S2c) commands upon reception of a wake-up and control message.

11. A method according to anyone of the claims 9 or 10, characterized in that

the slave node (SA) of said second type performs the steps of

- 5 - wirelessly receiving (S3a) digitally encoded polling and/or control information from said master node (109),
- after having detected (S3a') a valid identification code of said master node (PU) in the header of the received polling and/or control information, executing (S3d) a remotely controllable application running on said slave node (SA) for monitoring (S3e) and gathering (S3e') operational parameters of said slave node (SA) and/or environmental data detected by sensor elements (SSA) connected to said slave node (SA), in the following referred to as „status information“, and/or controlling (S3e'') actuator elements (ASA) controllable by said slave node (SA), and
- 15 - wirelessly transmitting (S3f) a digitally encoded version of said status information as a feedback signal to said master node (PU).

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12. A method according to anyone of the claims 9 or 10, characterized in that

the slave node (SA) of said second type performs the steps:

- while not being in vicinity of a master node (PU), wirelessly transmitting (S3f) feedback information from an application running on said slave node (SA) to a further node (SA') upon reception of a wake-up and/or remote control signal from said further node (SA') and,
- 25 - while being in vicinity of a master node (PU), wirelessly transmitting (S3g) data or requested status information upon reception of a polling request message from the master node (PU) by backscattering an RF signal obtained by modulating an electromagnetic field provided by said master node (PU) or any other node in said network with an encoded
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signal representing said status information to said master node (PU).

13. Use of a remote polling and control system according to  
5 anyone of the claims 1 to 8 for controlling applications running on nodes of a wireless sensor network (WSN).